Project Scale Carbon Effects – Crow Creek Pipeline
Caribou National Forest, Intermountain Region

1.1 Carbon and Greenhouse gas emissions

Forests play an important role in the global carbon cycle by taking up and storing carbon in plants and soil. Forestry has gained attention in recent decades because of its potential to influence the exchange of carbon with the atmosphere, either by increasing storage or releasing carbon emissions. Forests have a carbon "boom and bust" cycle. They take up and store atmospheric carbon as they grow through photosynthesis and release carbon through mortality due to aging or disturbances. Following mortality events, forests regrow and the cycle continues. Forests can store carbon in soils and plant material as well as in harvested wood products outside of the forest ecosystem.

1.1.1 Direct and Indirect Effects Analysis Boundaries

The effects analysis area for carbon includes forested lands within the Caribou NF because this is where the Crow Creek Pipeline project would occur. The effects analysis for greenhouse gas emissions is the global atmosphere given the mix of atmospheric gases can have no bounds. The timeframe for the analysis is out to 2030 when potential natural gas consumption would be at its maximum (i.e., maximum based on pipeline capacity).

1.1.2 Context

Forests in the Caribou NF are maintaining a carbon sink and forest carbon stocks between 1990 and 2013 (USDA Forest Service, 2015). The negative impacts on carbon stocks caused by disturbances and climate conditions have been minimal and exceeded by forest growth. Over half of the stands in the Caribou NF are middle-aged and older (greater than 80 years) and there has been a sharp decline in new stand establishment in recent decades (Birdsey *et al.*, in press). If the Forest continues on this aging trajectory, more stands will reach a slower growth stage in coming years, potentially causing the rate of carbon accumulation to decline.

Lower Valley Energy (LVE) provides natural gas to Afton, Wyoming by purchasing and trucking liquified natural gas (LNG) from the Exxon plant in La Barge, Wyoming and the Merit plant in Evanston, Wyoming. The Crow Creek Pipeline project would construct a 12-inch or less outside diameter, high pressure natural gas pipeline within a right-of-way (ROW) between a tie-in at the Williams Gas Company trunk line located south of Montpelier, Idaho and an LVE receiving facility in Afton, Wyoming. Though LVE intends to maintain and operate the existing LNG storage and vaporization facility as a backup to the pipeline, the main gas supply would be the pipeline. LVE may eventually choose to retire the LNG facility and rely entirely on the pipeline for natural gas supply if conditions warrant.

1.1.3 Direct, Indirect and Cumulative Effects

As outlined in Section 1.1, the Crow Creek Pipeline project has the potential to effect carbon stocks and greenhouse gas concentration due to two mechanisms: 1) disturbance and the release of stored carbon, and 2) the consumption of fossil fuels during construction and operation of the pipeline. These mechanisms are discussed separately below.

Disturbance and Caribou NF Carbon Stocks

The proposed Crow Creek Pipeline project would construct the proposed pipeline within a temporary 50-foot ROW/easement (25-foot width in wetlands and aquatic influence zones). In general, all movement during construction along the corridor would be drive and crush with no blading or clearing of ground for travel purposes. Total disturbance would be approximately 296 acres, with most of that disturbance occurring in shrub dominated vegetation communities. Approximately 17 acres of forested land would be disturbed. In terms of forests, this scope and degree of change would be negligible, affecting a maximum of 0.01 percent of the 2,095,270 acres of forested land in the Caribou NF. Although some very small areas of forest would remain cleared for pipeline maintenance, all disturbance would be reclaimed and revegetated. As a result, any carbon released to the atmosphere as part of construction related disturbance would have a temporary influence on atmospheric carbon concentrations because carbon would be removed from the atmosphere as vegetation regrows, minimizing or mitigating any potential cumulative effects. In the absence of the pipeline, the forests where the Crow Creek Pipeline project would take place would thin naturally from mortality-inducing natural disturbances and other processes resulting in dead trees that would decay over time, emitting carbon to the atmosphere. In addition, the effect of the Crow Creek Pipeline project focuses on the aboveground carbon pool that is stored in live woody vegetation, which comprise about 27 percent of the total ecosystem carbon stocks of the Caribou NF (USDA Forest Service 2015). About 33 percent or more of the ecosystem carbon is in mineral soils, a very stable and long-lived carbon pool (McKinley *et al.*, 2011; USDA Forest Service 2015; Domke *et al.* 2017).

Greenhouse Gas Emissions

The United States Environmental Protection Agency (USEPA) calculates GHG emissions based on a carbon dioxide equivalent (CO_2e) basis. The primary natural and synthetic GHGs in the Earth's atmosphere are water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases. All emissions associated with this project are CO_2, CH_4, and N_2O. The CO_2e estimates are established by calculating the individual constituents explained below and then applying appropriate global warming potential multipliers (GWP). The GWPs are defined by the USEPA Part 98 Table A-1.

The current baseline condition for GHG emissions consists of LNG combustion and vehicle miles traveled (VMT) to deliver LNG. Current annual natural gas combustion in the area that would be served by the Crow Creek Pipeline project is 95 million cubic feet (mmcf). Current VMT varies between a minimum of 30,800 and a maximum of 33,600. Based on this information, current maximum annual GHG emissions are approximately 5,753 tons CO_2e.

Construction of the Crow Creek Pipeline project has short and long term GHG emissions potential. Short-term construction emissions would be via diesel and gasoline combustion and material delivery truck emissions. Long term emissions would consist of increased natural gas combustion. In addition, there would be fewer LNG truck trips following construction of the pipeline. Annual natural gas combustion in the area that would be served by the Crow Creek Pipeline project would initially be the same as current usage (95 mmcf) but has the potential to rise to 122 mmcf by the year 2030 with construction of the pipeline. The Crow Creek Pipeline would decrease the amount of VMT by a minimum of 30,800 and a maximum of 33,600. Pipeline construction is expected to last up to eight months over a two-year window (April 2020 to November 2021). The schedule would be 10 hrs/day and 5 days/week for the eight months. It is assumed that four weeks comprises a month, which equates to 1,600 total hours for the duration of construction. During construction, pipe sections would be delivered by delivery trucks. Total trips are expected to be 100 with each round trip being approximately 700 miles. Construction workers would travel approximately 50 miles round trip and it is estimated that 12 trucks are used each day. All emissions were determined by equipment specific fuel consumption rates (gallon/hour) and USEPA GHG emission factors (Tables 1 and 2).

Table 1 – Construction Equipment List (1,600 hr Construction Period)

Equipment List	# of unit	Model	gal/hr[1,2]	Total Gals
Trackhoe/Excavator	3	CAT 320	4.6	22,080
Front End loader	1	907M	2.5	4,000
Skidster	1	246D	3.2	5,120
Dozer	1	D6	9.4	15,040
Fusing Machine	1	Trac12	2.2	3,520
Komatsu mini excavator	2	PC88mr-10	3	9,600

1. https://wheelercat.com/wp-content/uploads/2018/07/SEBD0351_ED48.pdf
2. CAT 320 with C 4.4 ACERT engine, CAT 308E worse-case mini excavator worst-case D6 used as equivalent

Table 2 – EPA Emission Factors

Emission Type[1]	CO_2	CH_4	N_2O	CO_2 units	CH_4 & N_2O Units
Natural Gas Consumption	0.05444	0.00103	0.0001	kg/cf	g/cf
Diesel Heavy-Duty Vehicles	10.21	0.0051	0.0048	kg/gal	g/mi
Construction - Diesel	10.21	0.57	0.26	kg/gal	g/gal
Commuter Truck Travel - Gas	0.472	0.019	0.018	kg/vmt	g/vmt

1. https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

Based on the factors described above and listed in Tables 1 and 2, annual GHG emissions during construction would be 6,597 tons CO_2e. This would be an increase of 844 tons CO_2e relative to current use (5,753 tons CO_2e). This estimate assumes one year of LNG combustion during construction because although the construction period would stretch over two years, actual construction is expected to be only eight months long. This estimate also assumes the maximum amount of VMT to deliver LNG. Following construction, there would be a slight decrease in annual GHG emissions due to the reduced trucking of LNG and annual GHG emissions would be approximately 5,642 tons CO_2e. Over time, natural gas combustion could increase up to 122 mmcf per year which would increase annual GHG emissions to a maximum of 7,260 tons CO_2e (a maximum annual increase of 1,507 tons CO_2e relative to current use).

For context, the 2014 USEPA National Emissions Inventory data illustrates that Bear Lake and Caribou Counties in Idaho and Lincoln County in Wyoming have a combined GHG total of 422,588 tons CO_2e. Therefore, the increase in GHG emissions relative to existing GHG emissions for the area would be 0.2 percent during construction and 0.4 percent in 2030 assuming the maximum future consumption. Climate change is a global phenomenon, because major GHGs mix well throughout the planet's lower atmosphere (IPCC 2013). Considering emissions of GHGs in 2010 were estimated at 13,336 ± 1,227 teragrams[1] carbon globally (IPCC 2014) and 1,881 teragrams carbon nationally (USEPA, 2015), the Crow Creek Pipeline project would make an extremely small direct contribution to overall emissions. Further, because

[1] These estimate use carbon mass, not CO_2 mass, because carbon is a standard unit and can easily be converted to any other unit. To convert carbon mass to CO_2 mass, multiply by 3.67 to account for the mass of the oxygen (O_2).

local GHG emissions mix readily into the global pool of GHGs, it is difficult and highly uncertain to ascertain the indirect effects of emissions from single or multiple projects of this size on global climate.

Some assessments suggest that the effects of climate change in some United States forests may cause shifts in forest composition and productivity or prevent forests from fully recovering after severe disturbance (Anderson-Teixeira *et al.*, 2013), thus impeding their ability to take up and store carbon[2] and retain other ecosystem functions and services. Climate change is likely already increasing the frequency and extent of droughts, fires, and insect outbreaks, which can influence forest carbon cycling (Kurz *et al.*, 2009; Allen *et al.*, 2010; Joyce *et al.*, 2014). However, the small quantity of carbon released to the atmosphere as a result of the project is unlikely to have an effect on the carbon cycle of the Caribou NF. In summary, this proposed project affects a relatively small amount of forest land and carbon on the Caribou and might temporarily contribute an extremely small quantity of GHG emissions relative to national and global emissions.

[2] The term "carbon" is used in this context to refer to CO_2.

1.1.4 References

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